

Adding Up the Climate Benefits of C&D Recycling

New calculator accounts for recycling's role in cutting greenhouse gas emissions

BY JENNIFER ROBERTS

"I don't get no respect," the late comedian Rodney Dangerfield frequently lamented. The same could be said of C&D recycling, at least in terms of its relationship to a building's greenhouse gas emissions.

Energy, on the other hand, gets most of the glory. By now, building designers, contractors, and developers have gotten the message that energy efficiency and renewable energy are the tickets to decreasing a building's carbon footprint.

LEED, a widely recognized certification program for green buildings, allots nearly one-third of the points in its rating system to strategies that reduce the use of fossil fuel-based energy and increase reliance on renewable forms of energy like solar and wind. C&D recycling earns a building only a point or two out of a possible 110 points in the LEED for New Construction rating system.

Similarly, greenhouse gas inventory tools used by municipalities and businesses to tally their emissions also tend to emphasize the easily measured benefits of energy efficiency while discounting the harder-to-

quantify climate benefits of C&D recycling.

While energy conservation may always take center stage, many experts believe that C&D recycling deserves a bigger share of the spotlight.

Wesley Sullens is a program manager with StopWaste.Org, a waste-reduction agency located east of San Francisco in Alameda County, Calif. In recent years, the agency has been looking closely at the connections between greenhouse gas emissions and waste reduction. "We have found that when building a new house in California, C&D reuse and recycling saves 5.7 metric tons of CO₂ emissions compared to landfilling," he said. "That's the equivalent of taking one car off the road for a year."

Research spearheaded by StopWaste.Org shows that for homes built to meet the standards of GreenPoint Rated, a consumer label for green homes in California, the emissions reductions of C&D recycling outweigh those achieved through energy efficiency and renewable energy generation, at least for the first few years of occupancy.

If this were more widely understood, Sullens believes it would not only provide a boost to the C&D recycling sector but would help cities and states more quickly reach their targets for cutting greenhouse gas emissions. "Municipalities are under the gun to get emissions down fast. Ramping up C&D recycling can be one of the most effective ways to do that," Sullens said.

The Waste Stops Here

StopWaste.Org operates as one integrated public agency comprised of the

Alameda County Waste Management Authority and the Alameda County Source Reduction and Recycling Board. Funded by waste disposal fees, the agency promotes source reduction, residential and commercial recycling, recycled product procurement and market development, technical assistance, and public education.

StopWaste.Org serves the county and 14 cities of Alameda County, as well as two sanitary districts that provide refuse and recycling collection services. Although local in scope, the agency is a national leader in developing solutions to reduce waste of C&D material and other resources. One of its most influential projects is the Residential Green Building Guidelines for single-family and multifamily homes.

"We originally developed the Guidelines in collaboration with and for the benefit of the local residential construction industry, but now the Guidelines are in widespread use throughout California," said Meri Soll, who manages construction and demolition recycling and green building projects for StopWaste.Org.

Tallying Savings

In 2008, StopWaste.Org launched a new initiative, the GreenPoint Rated Climate Calculator, in partnership with two organizations, the California-based nonprofit group, Build It Green, and ICLEI, an international organization that provides local governments with technical consulting on sustainable development. Much of the research and programming was done by KEMA Services Inc., a green building consulting firm.

The GreenPoint Rated Climate Calculator is "the nation's first third-party verified residential green building calculator created to measure the greenhouse gas emissions impacts—beyond just energy—from building green homes," said Tenaya Asan, program manager, GreenPoint Rated.

The Climate Calculator was created as an adjunct to the GreenPoint Rated program, a consumer label for green

homes in California developed jointly by StopWaste.Org and Build It Green. Inputs for the calculator are collected by third-party certified GreenPoint Raters; output data is expected to be available by the end of this year in a web-based program.

GreenPoint Rated homes are built to surpass California's building and energy code requirements, with features like improved insulation, sealed ducts, energy- and water-efficient appliances, solar electric and solar hot water systems, high efficiency toilets, and landscaping designed to reduce water use and green waste.

The new Climate Calculator quantifies the emissions avoided when building a GreenPoint Rated home or using green remodeling practices by comparing the carbon footprint of the GreenPoint Rated home to that of a conventionally built home. "When a house undergoes the GreenPoint Rating process, the third-party rater uses the Climate Calculator to generate data on greenhouse gas emissions avoided," said Sullens.

ICLEI and KEMA provided technical support when it came to analyz-

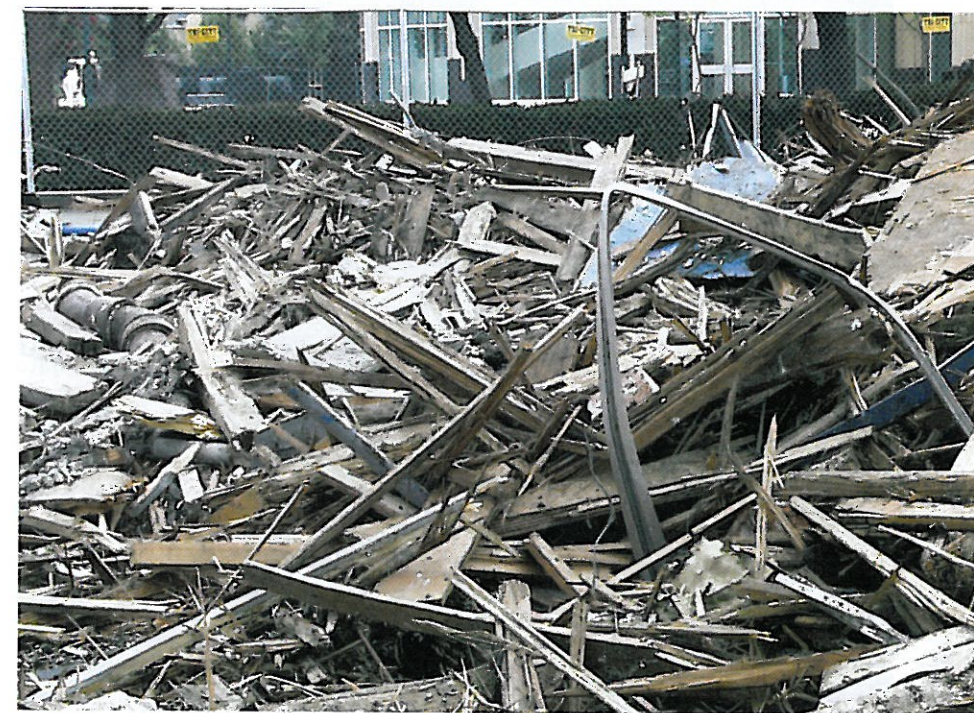
ing methodologies for attributing greenhouse gas emissions to green building features like energy efficiency, water savings, and C&D reuse and recycling. The Climate Calculator also tabulates non-CO₂ savings, including tons of waste, gallons of water, kilowatt-hours of electricity, and therms of natural gas.

Carbon footprint calculators and private-sector and public-sector carbon inventories typically include greenhouse gas emissions from sources that are relatively easy to quantify, like electricity consumption and transportation. What makes the GreenPoint Rated Climate Calculator unique is that it also quantifies savings from C&D recycling.

"Recycling is often left out because it's considered indirect and too difficult to quantify," said Timonie Hood, who works on green building programs for the U.S. Environmental Protection Agency's Pacific Southwest region. "But times are changing."

Upstream & Downstream Benefits

To add up the carbon savings from C&D recycling, the GreenPoint Rated



Downstream embodied energy is all the energy consumed as a result of the material's eventual disposal, including transportation and landfilling.

Representative Green Home*

	A	B	C	D	E	F
Material	C&D Composition	Calculated C&D Waste (Tons)	Assumed Diversion Rate	Diversion (Tons)	MTCO2E/Ton of Waste Recycled	MTCO2E Savings
Wood	42%	3.6	95%	3.4	0.8	2.6
Wallboard	13%	1.1	95%	1.0	NA	NA
Concrete	15%	1.3	95%	1.2	0.1	0.1
Cardboard	6%	0.5	95%	0.5	3.5	1.7
Metal	3%	0.3	95%	0.2	5.3	1.3
Other (including green waste)	21%	1.8	0%	0.0	NA	NA
Totals	100%	8.5		6.4		5.7

Keeping 95% of C&D wood, concrete, cardboard, and metal out of a landfill results in greenhouse gas savings of 5.7 MTCO2e. Results are for building one 2,000-square-foot wood-framed home in Alameda County, Calif. (MTCO2e is metric tons of carbon dioxide equivalent, a standard international metric used in carbon emission accounting.)

*Data based on possible recycling values, not from an as-built home.

Emissions Reductions by Measures*

Measures	Emissions Reductions Year 1 (Tons)	Percent of Emissions Year 1	Emissions Reductions Year 10 (Tons)	Percent of Emissions Year 10
Solid Waste Management				
Recycle construction & demolition waste (6.4 tons of waste)	5.7	75%	5.7	24%
Energy Efficient Design				
ENERGY STAR qualified appliances	0.4	5%	3.0	12%
Renewable Energy Generation				
2.4 kW photovoltaic system & solar hot water system	1.1	15%	11.0	44%
Indoor Water Conservation				
Water saving appliances, high efficiency toilets, low-flow fixtures	0.01	0%	0.1	0%
Bay-Friendly Landscape				
Plant selection, reduce lawn size, keep plant debris on site	0.1	1%	1.0	4%
Equivalent tons of CO₂ saved per new home	7.5	100%	24.8	100%

For a home built to meet GreenPoint Rated standards, C&D recycling accounts for 75% of emissions reductions in the first year after construction. Ten years out, that one-time occurrence of C&D recycling still accounts for a significant 24% of the home's total emissions reductions. *Data based on possible recycling and energy saving values, not from an as-built home.

Behind the Numbers

Currently, the GreenPoint Rated Climate Calculator can only be used by certified raters during the GreenPoint Rating process. But the methodology used to create the Climate Calculator and the results of calculations based on representative green home designs are publicly available in the March 2009 report, "The GreenPoint Rated Climate Calculator," available on StopWaste.Org's Web site.

Some of the Climate Calculator's numbers buck the conventional wisdom of greenhouse gas reporting

methods. When it comes to wood in landfills, for example, the Climate Calculator diverges from the EPA's Waste Reduction Model. "We didn't agree with all the assumptions used in WARM," said Sullens. "WARM treats landfilling wood as a net reduction of carbon under the theory that the carbon content of wood is locked up in the landfill indefinitely and thus doesn't end up back in the carbon cycle." In the GreenPoint Rated Climate Calculator, WARM's carbon sequestration credit for wood is

zeroed out. We give credit for recycling wood for biofuel, not for burying it."

One of the prerequisites of receiving a GreenPoint Rating for a newly built home is recycling at least 50% of C&D wood, cardboard, metal and concrete. But to give credit where credit is due, the Climate Calculator assumes a 95% recycling rate. "We've found that when new home builders recycle those four materials on their jobs, the recycling rate is nearly 100%," said Soll.

Climate Calculator accounts for the most common C&D streams including wood, cardboard, concrete, green waste, metal, and mixed materials sent to recycling centers.

Some of the metrics in the Climate Calculator derive from the EPA's Waste Reduction Model (WARM), a web-based tool that people can use to compare the greenhouse gas emissions of various waste management practices, including source reduction, recycling, composting, combustion, and landfilling.

The Climate Calculator uses some of the emissions coefficients from WARM to calculate the benefits of reusing or recycling C&D waste for an individual house. In WARM, each material has a corresponding greenhouse gas emissions factor that is a function of its embodied energy both upstream and downstream of the material's use.

Upstream embodied energy refers to all the energy used to make the product, including when mining, harvesting, and processing the raw materials, manufacturing the product, and transporting it. Downstream embodied energy is all the energy consumed as a result of the material's eventual disposal, including transportation and landfilling.

Like Taking 2.6 Million Cars off the Road

After developing the GreenPoint Rated Climate Calculator, the project researchers used it to calculate emissions reductions for a variety of representative green home designs. As a baseline, they used data from conventionally built homes.

The researchers found that recycling 95% of the C&D wood, concrete, cardboard and metal when building one new representative green home is equivalent to avoiding 5.7 MTCO2e of greenhouse gas emissions. (MTCO2e stands for metric tons of carbon dioxide equivalent, a standard international metric used in carbon emissions accounting.)

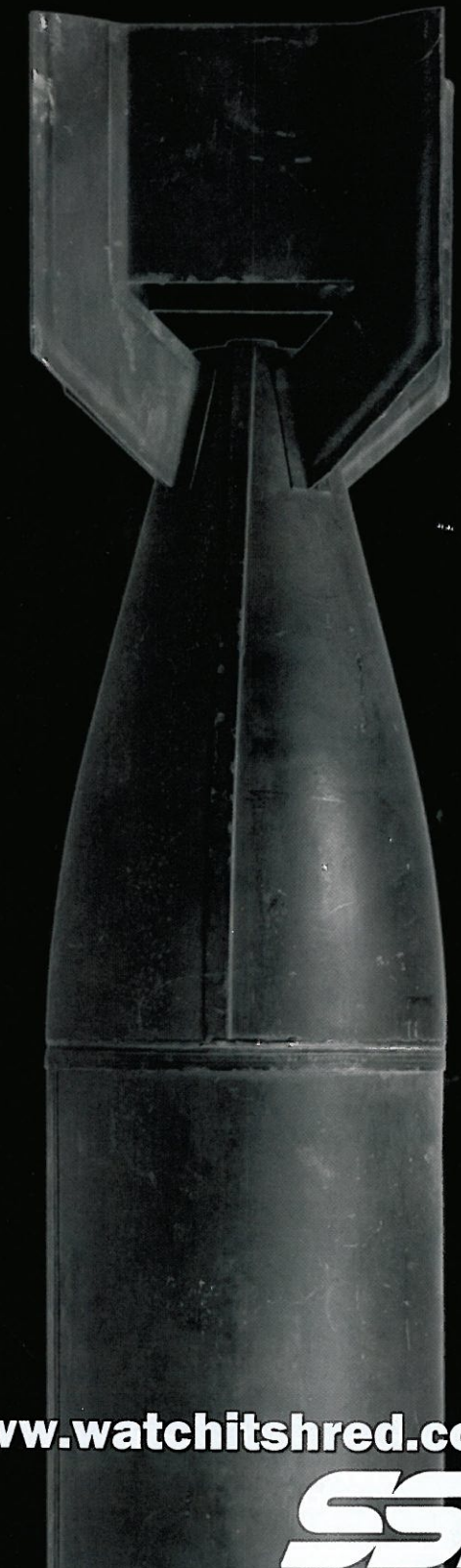
While that may sound modest on a per-house basis, the numbers add up quickly.

In California alone, an estimated 2.6 million new homes will be built by 2020, according to California Energy Commission forecasts. If the C&D material for each of these homes were recycled, emissions would be reduced by more than 14.8 million MTCO2e. That's comparable to the annual greenhouse gas emissions from more than 2.6 million passenger vehicles, or the carbon dioxide emissions from more than 1.6 billion gallons of gasoline.

"It makes sense to emphasize the climate benefits of energy efficiency and renewable energy systems because they are ongoing," Sullens said. "They continue to accrue savings year after year for the life of the building or the system. Conversely, C&D recycling and the associated emissions are counted as one-time events."

But emissions reductions from C&D recycling should not be discounted merely because they occur only at the time of construction or demolition. C&D recycling still provides significant carbon savings. "In actuality, the WARM model uses a lifecycle perspective of the materials, from extraction to disposal. So in effect you're not

MASS DESTRUCTION OF WEAPONS.



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really looking at a one-time number. You're looking at lifecycle impacts over roughly 30 years—the material's estimated life span," said Sullens.

For a new green home in California where the builder recycles 95% of C&D material, recycling accounts for a whopping 75% of total emissions reductions in the first year

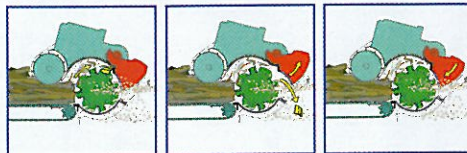
after construction, according to the Climate Calculator research (See Table 2). After 10 years, the relative impact of recycling C&D waste shrinks because the savings do not accumulate over time; however, that one-time occurrence of C&D recycling still accounts for a significant 24% of the home's cumulative emissions reductions.

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Giving C&D Recycling the Respect It Deserves


Although C&D recycling happens only one time for a particular project, the climate benefits are actually more enduring from the community's perspective, Sullens explained. "Building construction and demolition are ongoing activities, so cities and local governments should consider waste an ongoing source of greenhouse gas emissions."

Since most carbon footprint calculators and greenhouse gas inventory tools don't fully account for the upstream and downstream benefits of C&D reuse and recycling, public policy and private decisions get steered toward energy efficiency while reuse and recycling take a back seat. "The GreenPoint Rated Climate Calculator is a step toward restoring balance, not just in the public policy realm but also for the climate," said Sullens. "Generally only those emissions that are quantified upfront in an initial greenhouse gas inventory are prioritized and acted upon. Policymakers and people in the waste management industry can help speed us toward a lower carbon society by making sure the benefits of C&D recycling are taken into account. It's less sexy than renewables or energy upgrades in homes, but in most markets—especially in California—recycling waste is much more cost effective per ton of carbon saved."

Resources

- *StopWaste.Org*: www.StopWaste.org
- *GreenPoint Rated*: www.BuildIt-Green.org/greenpointrated
- U.S. EPA's *Waste Reduction Model (WARM)*: www.epa.gov/WARM
- *LEED 2009 Rating Systems*: www.usgbc.org

Author Information

Jennifer Roberts is a San Francisco-based writer and the author of books about green homes, including "Redux: Designs That Reuse, Recycle and Reveal." She can be contacted through her Web site, www.jennifer-roberts.com. 

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1. That is your primary business at this location?

- | | |
|---|--|
| <input type="checkbox"/> 1a C&D materials recycling | <input type="checkbox"/> 1b Construction/Road construction |
| <input type="checkbox"/> 1c Demolition Contractor | <input type="checkbox"/> 1d Private landfill/Waste management services |
| <input type="checkbox"/> 1e Aggregate producer | <input type="checkbox"/> 1f Deconstruction/Reuse store |
| <input type="checkbox"/> 1g Consultant/Engineer | <input type="checkbox"/> 1h Equipment Manufacturer |
| <input type="checkbox"/> 1i Scrap processor | <input type="checkbox"/> 1j Other (Describe) <input type="text"/> |

2. What best describes your title?

- | | |
|---|---|
| <input type="checkbox"/> 2a Owner/Partner | <input type="checkbox"/> 2b President/ Vice President |
| <input type="checkbox"/> 2c Corporate/Executive Officer | <input type="checkbox"/> 2d General Manager/Director |
| <input type="checkbox"/> 2e Manager/ Superintendent | <input type="checkbox"/> 2f Foreman/Supervisor |
| <input type="checkbox"/> 2g Specialist | <input type="checkbox"/> 2h Recycling Coordinator/Other Coordinator |
| <input type="checkbox"/> 2i Purchasing Buyer | <input type="checkbox"/> 2j Other (Describe) <input type="text"/> |

3. Which of the following materials are handled at this location?

- | | |
|--|--|
| <input type="checkbox"/> 3a Concrete/Asphalt | <input type="checkbox"/> 3b Asphalt Shingles |
| <input type="checkbox"/> 3c Wood | <input type="checkbox"/> 3d Gypsum |
| <input type="checkbox"/> 3e Scrap metals | <input type="checkbox"/> 3f Mixed C&D |
| <input type="checkbox"/> 3f Other <input type="text"/> | |

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